(1) Is “undetectable errors” possible using CRC? If yes, show it by an example. If not, explain why not.

- Undetectable errors are possible using CRC.
- Undetectable errors happen when the error bit patterns match with the key as shown below:

Note: this is an example (other correct examples are possible)
(2) Can a CRC code correct transmission errors? If yes, show it by an example. If not, explain why not.

   No. CRC code does NOT correct errors.

   It is because the FCS and the receiver-side process for detecting errors can not re-construct the location information of the error bits (can not tell which bits are error bits).

(3) What are the two “sliding-window based ARQ methods (just name the two)?

   • Selective-reject ARQ
   • GBN-ARQ

(4) What is the primary advantage of “GBN-ARQ” over “selective-reject ARQ”?

   Using selective-reject ARQ, receivers have to buffer (keep) all the packets after a packet in error. In high-speed networks, the number of the packets receivers have to hold can be large, risking the buffer (memory) overflow. Since receivers do not hold packets, GBN reduces the risk of buffer (memory) overflow in the receiver side.

(5) What is the expected link utilization of selective-reject-ARQ (show its formula)?

   \[
   U = \begin{cases} 
   \left(\frac{(N \cdot T)}{(T + 2 \cdot G)}\right) \times \left(\frac{1 - P}{1}\right) \times 100\% & \text{If } (N \cdot T) < (T + 2 \cdot G), \\
   100 \times \left(\frac{1 - P}{1}\right) \% & \text{Otherwise:} 
   \end{cases}
   \]

   when the packet error-rate is P (0.0 \leq P \leq 1.0)